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ABSTRACT

Three classroom experiments were conducted using a simulation game, Trade and Develop, designed for classroom use with students in grade six through twelve economic geography classes. The hypotheses tested were: a simulation game will motivate students to learn subject matter related to the game, and, the game will facilitate learning by acting as an organizer. A suburban junior high school and high school were involved. Within each class, students of the same sex were paired according to their ranking on a standardized test of verbal ability, then one member of each pair was assigned at random to the experimental group. Only the experimental group played the game. Both control and experimental groups answered a brief questionnaire consisting of two items intended to measure motivation for the learning task. The students then took part in the task which required verbal recall of facts and principles. The material was presented by filmstrip in the first experiment, by textbook in the last two, and, the tests for each experiment were different. There were no large or significant differences between experimental and control groups for either sex, on any of the three variables (reading, motivation, learning), in any of the three studies. (SBF)

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THE JOHNS HOPKINS UNIVERSITY

THE CENTER FOR THE STUDY OF SOCIAL ORGANIZATION OF SCHOOLS

REPORT No. 64

SIMULATION GAMES AS ADVANCE ORGANIZERS IN THE LEARNING OF SOCIAL SCIENCE MATERIALS: EXPERIMENTS 1-3

BY

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Simulation Games as Advance Organizers in the Learning of Social Science Materials: Experiments 1-3

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SUMMARY

Three experiments were conducted to test the hypotheses that: (1) a simulation game will motivate students to learn subject matter related to the game, and (2) it will facilitate learning by acting as an organizer. Within each class, students of the same sex were paired on reading ability; one member of each pair was then assigned at random to the experimental group. Only the experimental group played the game. Both groups together then answered a brief questionnaire intended to measure motivation and attempted the learning task. The results showed no significant difference between the two groups, in either motivation or learning, in any of the three experiments.

INTRODUCTION

This paper is a report of three classroom experiments with a simulation game designed to teach economic geography. Most previous studies of the educational effectiveness of simulation games have been attempts to measure the learning that results directly from playing simulation games. Cherryholmes (1966) summarizes six of these; others include those of Anderson (1969), Boocock (1966), Boocock et al. (1967), Farran (1968), and Wing (1966). The consensus of these studies is that students do learn by playing simulation games, but they do not learn significantly more from the games than from other forms of presentation of the same material.[1]

The experiments reported in this paper represent a different approach: an attempt to find out whether playing a simulation game facilitates the learning of related subject matter in activities which follow the game. There are two major hypotheses which suggest this approach:

> 1) Playing a simulation game increases the student's motivation to learn related subject matter, and his increased motivation produces superior learning.
>
> 2) Playing a simulation game provides the student with an organizational framework which helps him learn related subject matter.

The first of these hypotheses will be referred to as the "motivation" hypothesis; the second, as the "organizer" hypothesis.[2]

There have been many studies of the effects of motivation on learning, but few investigators have attempted to measure the effect of interest on learning in specific areas of school subject matter. One who did was French (1965); he found that items which asked students

whether they liked or disliked certain learning activites could be used to predict their grades in those subject areas.

There have been several studies on the use of "organizers" to facilitate learning and retention. These studies generally show superior learning by the group receiving the organizer, which can be a set of instructions (Katona, 1940; Hilgard et al., 1964), an order of presentation of learning tasks (Grotelueschen and Sjogren, 1968), or an introductory paragraph in a reading selection (Ausubel, 1960; Ausubel and Fitzgerald, 1961 and 1962). However, in none of these studies was the organizer a separate and different activity from the learning task.

One study in which the organizer was a game is that of Scandura and Wells (1967), in which the group receiving the organizer outperformed the control group on a learning task in abstract mathematics. Scandura and Wells' design is highly similar to the one used in the experiments reported in this paper; however, both the game and the learning task took more time in these experiments than in theirs.

GENERAL METHOD

These experiments were conducted in a suburban junior high school and a suburban high school near Baltimore. Different subjects were used for each of the three experiments, but the basic design was the same for all three. The students in each class (boys and girls separately) were ranked on the basis of a standardized test of verbal ability. They were then paired according to their ranking: the top two, the next two, and so on. (The students were not informed of these pairings.) One member of each pair was selected at random and assigned

to the experimental group; the other was assigned to the control group.

For the first two class periods of the experiment, the experimental group played the game while the control group worked on an unrelated exercise. This was the only time that the experimental and control groups were separated. At the beginning of the next class period, the students answered a brief questionnaire consisting of two items intended to measure motivation for the learning task.[3] The students then participated in the learning task and took the test on the material it presented.

The game used in these experiments was Trade and Develop, a game designed by the author for classroom use with students in grades six through twelve. In this game each player attempts to guide a national economy through the development process, making decisions of resource allocation and international trade.[4] This game seemed particularly suitable for these experiments because the role the student plays in the game does not correspond to one he is likely to play in real life. Therefore, the educational value of the game must lie in teaching the student about something, rather than teaching him to do something.

The learning tasks for the three experiments all required verbal recall of facts and principles of economic geography. In Experiment 1 the material was presented by means of a filmstrip; in Experiments 2 and 3 it was presented by means of a textbook. The tests for the three experiments were different, but all the items on each test could be answered directly from the filmstrip or textbook chapter which the students had just studied.

All the activities in these experiments were administered under

normal classroom conditions by the regular social studies teachers of the classes involved. If a student missed any of the activities of the experiment, data for that student and the student paired with him was discarded, in order to avoid introducing any bias into the groupings. As a result, in Experiments 2 and 3, which lasted a full week, only about half the original subjects could be used in the final comparisons.

RESULTS

Experiment 1

The subjects for Experiment 1 were eighth-grade students of low academic ability, in a world geography class which met in the late afternoon. Reading comprehension scores for this group ranged from the 33rd percentile to the 0.1 percentile.[5] The experiment was conducted during the fourth week of the school year; the questionnaire, the learning task, and the test were all administered on a Friday. The learning task consisted of viewing the filmstrip "Producing the World's Goods"[6] and hearing the captions read aloud. The test consisted of fifteen multiple-choice items, with four options per item.

The results are shown in Table 1. To permit statistical manipulation, the reading scores have been converted from percentiles to T-scores (normalized standard scores with mean = 50 and standard deviation = 10). Motivation scores are from the questionnaire.[7] Learning scores are the number of items answered correctly on the learning test.[8]

These results show no large or significant differences between experimental and control groups for either sex on any of the three

Table 1. Results of Experiment 1

Sex	Treatment	n	Reading		Motivation		Learning	
			Mean	S.D.	Mean	S.D.	Mean	S.D.
M	Exp.	8	36.7	9.83	3.75	1.39	9.88	1.81
	Ctl.	8	39.1	7.57	3.63	1.85	11.00	1.77
F	Exp.	3	38.2	4.50	*	*	6.67	4.16
	Ctl.	3	40.7	4.39	*	*	8.00	1.00
M + F	Exp.	11	37.1	8.50	*	*	9.00	2.83
	Ctl.	11	39.5	6.68	*	*	10.18	2.09
Maximum possible score:					6		15	

* No meaningful statistics possible because of missing data.

variables. (Note that the control group actually outperformed the experimental group on the learning test.)

Experiment 2

The subjects for Experiment 2 were eighth-grade students of average and above-average ability in two world geography classes. Reading comprehension scores for Class 1 ranged from the 93rd to the 42nd percentile; for Class 2, from the 83rd to the 36th percentile. Class 1 met in the late afternoon; Class 2 met just before lunch. The experiment was conducted in early October. The three parts of the learning task were administered on Friday, Monday, and Tuesday. The control group could not be sent to another room while the experimental group played the game, because no other room was available.

The learning task consisted of reading Chapters 2, 3, and 4 of International Economic Problems, by James D. Calderwood.[9] All the students were able to finish reading each chapter in the time allowed. Each reading period was followed by a test on the chapter just read. The tests were multiple-choice tests with four options per item.

The results are shown in Table 2. Reading and motivation scores were obtained as in Experiment 1. Learning scores are the total number of items answered correctly on all three tests.[10] Again there are no large or significant differences in either motivation or learning between experimental and control groups.

Experiment 3

The subjects for Experiment 3 were high school students of widely varying academic ability. Class 1 was an 11th-grade geography class which met early in the day; Class 2 was a 10th-grade world history

Table 2. Results of Experiment 2

Class	Sex	Treat-ment	n	Reading		Motivation		Learning	
				Mean	S.D.	Mean	S.D.	Mean	S.D.
1	M	Exp.	5	57.8	6.18	4.20	1.30	19.00	2.83
		Ctl.	5	55.9	7.08	4.00	1.22	15.80	4.92
	F	Exp.	4	59.6	2.80	4.50	.58	13.75	.96
		Ctl.	4	59.8	3.87	3.00	1.83	17.00	4.32
	M + F	Exp.	9	58.6	4.79	4.33	1.00	16.67	3.46
		Ctl.	9	57.7	5.90	3.56	1.51	16.33	4.42
2	M	Exp.	4	53.9	6.33	3.25	1.50	18.25	1.71
		Ctl.	4	55.1	5.45	3.75	.96	19.00	2.94
	F	Exp.	3	53.2	4.36	2.67	2.31	15.00	7.00
		Ctl.	3	51.2	4.99	2.67	1.15	17.67	5.51
	M + F	Exp.	7	53.6	5.15	3.00	1.73	16.86	4.56
		Ctl.	7	53.5	5.24	3.29	1.11	16.43	3.87
1 + 2	M	Exp.	9	56.1	6.19	3.78	1.39	18.67	2.29
		Ctl.	9	55.6	6.03	3.89	1.05	17.22	4.27
	F	Exp.	7	56.9	4.67	3.71	1.70	14.29	4.15
		Ctl.	7	56.2	6.08	3.86	1.46	17.29	4.42
	M + F	Exp.	16	56.4	5.42	3.75	1.48	16.75	3.84
		Ctl.	16	55.9	5.85	3.44	1.32	17.25	4.19
Maximum possible score						6		33	

class which met just after lunch. Verbal ability scores for Class 1 ranged from the 96th to the 3rd percentile; for Class 2, from the 87th to the 21st percentile.[11] The experiment was conducted early in December.

The learning task was the same as for Experiment 2. However, there were differences in procedure. The control group did go to another room for the two class periods during which the experimental group played the game. In Experiment 2 the control group had been told that they would play the game the following week; in this experiment they were told that they would not play the game, while the experimental group were told that they would play the game again the following week.

For this experiment, the multiple-choice tests were replaced by tests made up of short-answer items, which required the student to supply the correct answer instead of selecting it from four alternatives presented. As in Experiment 2, all items could be answered by recall from the textbook chapters. The students also took a retention test three days after completing the learning task. The retention test consisted of items selected from the other three tests and presented in random order. The learning task was administered on Wednesday, Thursday, and Friday; the retention test on the following Monday.

The results are shown in Table 3. Motivation scores for Class 1 were unavailable because the teacher neglected to tell the students to put their names on their questionnaires. Verbal ability scores have been converted from percentiles to T-scores. The learning and retention tests were scored by the experimenter, who did not know which students had played the game until he had finished scoring all

Table 3. Results of Experiment 3

Class	Sex	Treatment	n	Verbal Ability		Motivation		Learning		Retention	
				Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
1	M	Exp.	7	47.6	11.48	*	*	23.86	4.67	15.00	2.83
		Ctl.	7	48.5	11.67	*	*	24.71	2.50	15.71	.95
	F	Exp.	4	47.6	12.99	*	*	23.75	5.06	13.50	1.91
		Ctl.	4	48.7	14.65	*	*	25.00	6.00	14.25	4.27
	M + F	Exp.	11	47.6	11.39	*	*	23.82	4.56	14.45	2.54
		Ctl.	11	48.6	12.09	*	*	24.82	3.82	15.18	2.56
2	M	Exp.	5	47.6	2.89	2.60	1.14	15.20	2.95	9.40	2.61
		Ctl.	5	47.7	4.03	3.20	1.30	18.20	6.57	10.60	4.39
	F	Exp.	4	48.1	3.64	3.25	.50	19.50	5.20	10.75	4.27
		Ctl.	4	48.1	2.98	3.00	.82	22.00	3.56	12.00	2.94
	M + F	Exp.	9	47.8	3.03	2.89	.93	17.11	4.43	10.00	3.27
		Ctl.	9	47.9	3.39	3.11	1.05	19.89	5.51	11.22	3.66
1 + 2	M	Exp.	12	47.6	8.65	*	*	20.25	5.91	12.67	3.89
		Ctl.	12	48.2	8.96	*	*	22.00	5.51	13.58	3.80
	F	Exp.	8	47.8	8.84	*	*	21.62	5.27	12.13	3.39
		Ctl.	8	48.4	9.80	*	*	23.50	4.84	13.13	3.60
	M + F	Exp.	20	47.7	8.49	*	*	20.80	5.56	12.45	3.62
		Ctl.	20	48.2	9.05	*	*	22.60	5.17	13.40	3.63
Maximum Possible Scores:						6		36		21	

* Scores not available

the tests.[12] Once again, there were no significant differences between the experimental and control groups in either learning or retention.

DISCUSSION

The primary purpose of these experiments was to test the two hypotheses referred to earlier as the "motivation" hypothesis and the "organizer" hypothesis. The results do not support either hypothesis.

A secondary purpose of these experiments was to evaluate the effectiveness of this particular game as a teaching aid. One purpose of the game is to help students learn economic geography from materials other than the game. The results of the experiments show clearly that, with students like our experimental subjects, the game did not accomplish that purpose.

The absence of significant differences might be the result of the small size of the samples used in these experiments. It cannot be the result of "diffusion" or "contamination" effects, since in the third experiment these were controlled by keeping the groups separate while the experimental group played the game, and by telling the control group that they would not play the game. Nor can one claim that the students already knew the material presented in the learning tasks; the test scores show no "ceiling effect."

Experiments like these might possibly produce different results with a different kind of students. These experiments showed the game to be equally ineffective with 8th-graders, 10th-grader, and 11th-graders; with students of high, average, and low academic ability. But nearly all the students were white, from suburban areas, and without special handi-

caps. With younger students, or students from a different cultural background (for example, the inner city or rural Appalachia), or students with certain handicaps (for example, deafness), the game might have proved more effective. Possibly also a different game, with different learning tasks, might have produced positive results.

One more point should be noted. The teachers who administered these experiments in their classes all reported that their students were enthusiastic about the game and seemed to be learning from it. Yet these experiments failed to show a consistent advantage in the learning tasks for students who had played the game. It follows that students' and teachers' enthusiasm for a teaching device is not always a valid predictor of its success as measured by student performance on objective tests.

FOOTNOTES

[1]Baker (1968) reports findings that indicate superior learning for students learning through simulation, but Fletcher's (1970) comments on Baker's study cast doubts on the relevance of his results and the validity of his conclusions.

[2]For a more thorough presentation of these hypotheses, see Coleman (1967).

[3]Appendix A contains a copy of this questionnaire.

[4]Appendix B contains a somewhat more detailed description of the game.

[5]These scores are from the Iowa Test of Basic Skills, Form 1, administered two years previously. The scores are based on Baltimore County norms.

[6]McGraw-Hill Filmstrip no. 405217

[7]Motivation scores were unavailable for two female subjects because they forgot to put their names on their questionnaires. When the motivation scores of the girls they had been paired with were discarded, only one case in each cell remained; therefore, no meaningful statistics could be computed for motivation scores of female subjects in this experiment.

[8]The reliability of the learning test, by Kuder-Richardson Formula 20, was .58.

[9]Published by Scott, Foresman & Company. Chapter 1 of the book is merely a two-page introduction.

[10]The reliability of these scores, by Kuder-Richardson Formula 20, is .59.

[11]These scores are from the School and College Aptitude Test (SCAT), Form 2A, administered one year previously. The scores are based on Baltimore County norms.

[12]The reliability of the learning scores is .75; that of the retention scores is .63.

APPENDIX A

Motivation Questionnaire

1. Here is a list of things you might want to learn about other countries. Write the number 1 in the space next to the thing you would most like to learn; write the number 2 in the space beside your second choice; and so on.

   ( ) The names and locations of the country's large cities, rivers, mountains, and so on.

   ( ) The country's natural resources and how the people use them to make a living.

   ( ) The country's government and laws.

   ( ) The people's customs, habits, and beliefs.

2. In general, how interested are you in learning about other countries? (Check one.)

   ( ) very interested

   ( ) interested

   ( ) slightly interested

   ( ) not interested

Scoring:

Each item allowed a score of 0, 1, 2, or 3. The respondent's score for Item 1 was determined by the rank he assigned to the second option. If he ranked it first, he received 3 points; second, 2 points; third, 1 point; and fourth, 0 points.

APPENDIX B

A brief description of the game, Trade and Develop

Trade and Develop simulates the process of national economic development in a world economy. The purpose of the game is to give the players an intuitive understanding of this process and of certain fundamental concepts of economics.

Each player represents a country in an early stage of development. His goal is to give his country the highest possible standard of living. Players allocate labor and capital to three sectors of the economy: agriculture, consumer industry, and basic industry. Differences between countries in the productivity of each sector encourage trade. As capital is invested in each sector, that sector's labor productivity increases.

The game consists of six rounds, and each round consists of four stages: (1) Production, (2) Trade, (3) Investment, and (4) Consumption. Final scores are based on credits for consumption over the six rounds, plus extra credits for development at the end of the game.

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